



UNITED STATES PATENT AND TRADEMARK OFFICE

44

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/646,405	08/22/2003	Wei Wang	AMAT/3177.D1/CPI/L/B/PJS	9508
44257	7590	08/14/2006		
PATTERSON & SHERIDAN, LLP 3040 POST OAK BOULEVARD, SUITE 1500 HOUSTON, TX 77056				
EXAMINER MCDONALD, RODNEY GLENN				
ART UNIT		PAPER NUMBER		

1753

DATE MAILED: 08/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/646,405

Applicant(s)

WANG ET AL.

Examiner

Rodney G. McDonald

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-12 and 14-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-12 and 14-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 9, 2006 has been entered.

Claim Rejections - 35 USC § 112

Claims 1-4, 6-12 and 14-32 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. It is unclear where the specification highlights the deposition of a "metallic film". It appears that the film is a metallic nitride film of titanium.

Claims 1-4, 6-12 and 14-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-4, 6-12 and 14-32 are indefinite because it is unclear whether the layer will be "metallic" when the second gas is introduced.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3-6, 8-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. (Japan 10-324969) in view of Ngan (EP 0 840 351) and Yamaguchi (U.S. Pat. 6,203,674).

Regarding claims 1, Tadashi et al. teach a method of depositing metallic layers on a substrate comprising introducing argon gas into a vacuum chamber proximate a metal target. Power is supplied to the metal target and the RF coil in the presence of argon to form a very thin aluminum film on the substrate. After that electric power to the target is stopped and oxygen or nitrogen gas other than argon gas is introduced into the

Art Unit: 1753

vacuum chamber and the aluminum film is oxidized or nitrided with the plasma by the RF coil. (See Machine Translation paragraph 0006)

Regarding claims 3, From Fig. 1 the second gas is introduced proximate the upper surface of the substrate. (See Fig. 1; Here oxygen).

Regarding claims 4, power is applied to the target and coil to initiate plasma. (See Machine Translation paragraph 0006)

Regarding claims 5, the second gas can be introduced in a metallic deposition step. The reactant gas is introduced simultaneously for reactant sputtering. (See Machine Translation paragraph 0006)

Regarding claim 6, the first gas argon is introduced in a gas stabilization step. (See Machine Translation paragraph 0006)

Regarding claim 8, the first gas is argon. (See Machine Translation paragraph 0006)

Regarding claim 9, the second gas can be nitrogen. (See Machine Translation paragraph 0006)

Regarding claim 10, the first gas is the inert gas argon. (See Machine Translation 0006)

Regarding claim 11, the second gas is an active gas such as oxygen or nitrogen. (See Machine Translation 0006)

Regarding claim 12, the second gas is introduced after power has been applied to the target and the coil. (See Machine Translation 0006)

Art Unit: 1753

The differences not yet discussed are where the target is made of titanium, tantalum or tungsten (Claim 1), where the coil is made of titanium, tantalum and tungsten (Claim 14) and where metallic film layers are deposited (Claim 1)

Regarding claims 1 and 14, Ngan teach utilizing a target and coil made of titanium. (Column 12 lines 40-43)

The motivation for utilizing a target and coil made of a material such as titanium is that it allows for depositing a layer more uniformly. (Column 9 lines 5-8)

Regarding the deposition of metallic film layers (Claim 1), Yamaguchi teach depositing a metallic mode TiN film by sputtering a target containing a layer amount of Ti components. The selective formation of metallic mode TiN film can be performed by adjusting the ratio of Ar gas and N₂ gas or setting the flow rate of N₂ to a predetermined rate or more. (Column 3 lines 1-13)

The motivation for depositing a metallic mode TiN film is that it allows for forming a layer for a semiconductor device. (Column 1 lines 5-20)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Tadashi et al. by utilizing a target and coil made of titanium as taught by Ngan and to have formed a metallic mode TiN film as taught by Yamaguchi et al. because it allows for depositing a layer more uniformly and for depositing a film for a semiconductor device.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over 1, 3-6, 8-12 and 14 as applied to claims Tadashi et al. in view Ngan and Yamaguchi et al. above, and further in view of Maniv et al. (U.S. Pat. 4,392,931).

The difference not yet discussed is biasing the substrate (Claim 2).

Regarding claim 2, Maniv et al. teach utilizing RF energy applied to the substrate to cause transparencies of oxide films to be increased. (Column 3 lines 43-59)

The motivation for utilizing an RF bias to the substrate is that it allows for increasing transparencies of the deposited film. (Column 3 lines 43-59)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an Rf bias to the substrate because it allows for increasing the transparency of the film.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over 1, 3-6, 8-12 and 14 as applied to claims Tadashi et al. in view Ngan and Yamaguchi et al. above, and further in view of Lantsman (U.S. Pat. 5,830,330).

The difference not yet discussed is the ramping of the power to the target and coil. (Claim 7)

Regarding claim 7, Lantsman teach in Fig. 3 ramping the power to the target and coil to perform sputtering. (See Fig. 3)

The motivation for ramping the powers to the coil and target is that it allows for sustaining the plasma at low pressures. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have ramped the power to the coil and target as taught by Lantsman because it allows for sustaining the plasma at low pressures.

Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over 1, 3-6, 8-12 and 14 as applied to claims Tadashi et al. in view Ngan and Yamaguchi above, and further in view of Sone (U.S. Pat. 6,451,184).

The differences not yet discussed is where the first gas creates a higher partial pressure of first gas proximate to the sputtering target than at the upper surface of the substrate (Claim 15) and where the second gas creates a higher partial pressure of second gas proximate to the surface of the substrate than at the upper surface of the target (Claim 16).

Regarding claims 15 and 16, since Tadashi et al. teach locating the argon proximate the target in Fig. 1 and locating the oxygen gas proximate the substrate in Fig. 1 the apparatus would have inherently higher partial pressures of argon proximate the target and higher partial pressures of oxygen proximate the substrate. (See Fig. 1) Sone further teaches partitioning the gas space such that reactive gas is contained between the partition member and the substrate and the sputter gas is maintained between the target and the partition member. This keeps the partial pressure of reactive gas higher at the substrate surface than at the target surface and keeps the partial pressure of argon gas higher at the target surface than at the substrate surface. (See Abstract) Furthermore, Sone recognizes that the prior art has attempted to keep the sputtering gas confined to the target and the reactive gas confined to the substrate. (Column 2 lines 17-22)

The motivation for utilizing a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate is that it allows for production of

compound films with in-plane uniform thickness and optical and electrical characteristics. (Column 3 lines 22-25)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate as taught by Sone because it allows for production of compound films with in-plane uniform thickness and optical and electrical.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over 1, 3-6, 8-12 and 14 as applied to claims Tadashi et al. in view Ngan and Yamaguchi above, and further in view of Gilboa et al. (U.S. Pat. 5,108,569).

The differences not yet discussed is the use of a shield ring and shield support member.

Regarding claim 17, Gilboa et al. teach a shield ring and shield support member in Fig. 2 such that when the shield ring is supported by the substrate support member a gas can be introduced to the upper surface of the substrate. (See Gilboa et al. Fig. 2)

The motivation for utilizing a shield ring and shield support member is that it allows for clamping the wafer to the substrate support. (Column 8 lines 37-38)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a shield ring and support member as taught by Gilboa et al. because it allows for clamping the wafer to the substrate support.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over 1, 3-6, 8-12 and 14 as applied to claims Tadashi et al. in view Ngan and Yamaguchi above, and further in view of Chikako et al. (Japan 06-041733).

The difference not yet discussed is the introduction of reactive gas through the central portion of the substrate holder.

Regarding claim 18, Chikako et al. teach introducing reactive gas through the center of a substrate holder. (See Abstract; Figure 1)

The motivation introducing the reactive gas through the center of the substrate is that it allows for suppressing reaction products from building up on the surface of the target. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a reactive gas inlet at the center of the substrate holder as taught by Chikako et al. because it allows for suppressing reaction products from building up on the surface of the target.

Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. (Japan 10-324969) in view of Sone (U.S. Pat. 6,451,184) and Yamaguchi (U.S. Pat. 6,203,674).

Tadashi et al. is discussed above and all is as applies above. (See Tadashi et al. discussed above)

The differences not yet discussed is where the first gas creates a higher partial pressure of first gas proximate to the sputtering target than at the upper surface of the substrate, where the second gas creates a higher partial pressure of second gas

proximate to the surface of the substrate than at the upper surface of the target and the deposition of metallic layers.

Since Tadashi et al. teach locating the argon proximate the target in Fig. 1 and locating the oxygen gas proximate the substrate in Fig. 1 the apparatus would have inherently higher partial pressures of argon proximate the target and higher partial pressures of oxygen proximate the substrate. (See Fig. 1) Sone further teaches partitioning the gas space such that reactive gas is contained between the partition member and the substrate and the sputter gas is maintained between the target and the partition member. This keeps the partial pressure of reactive gas higher at the substrate surface than at the target surface and keeps the partial pressure of argon gas higher at the target surface than at the substrate surface. (See Abstract) Furthermore, Sone recognizes that the prior art has attempted to keep the sputtering gas confined to the target and the reactive gas confined to the substrate. (Column 2 lines 17-22)

The motivation for utilizing a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate is that it allows for production of compound films with in-plane uniform thickness and optical and electrical characteristics. (Column 3 lines 22-25)

Regarding the deposition of metallic film layers, Yamaguchi teach depositing a metallic mode TiN film by sputtering a target containing a layer amount of Ti components. The selective formation of metallic mode TiN film can be performed by adjusting the ratio of Ar gas and N₂ gas or setting the flow rate of N₂ to a predetermined rate or more. (Column 3 lines 1-13)

The motivation for depositing a metallic mode TiN film is that it allows for forming a layer for a semiconductor device. (Column 1 lines 5-20)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Tadashi et al. by utilizing a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate as taught by Sone and depositing metallic layer as taught by Yamaguchi because it allows for production of compound films with in-plane uniform thickness and optical and electrical and for forming a layer for a semiconductor device.

Claims 20 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone and Yamaguchi as applied to claims 19 and 21 above, and further in view of Maniv et al. (U.S. Pat. 4,392,931).

Tadashi et al. is discussed above and teach applying power to the target and coil in the presence of only an inert gas to form a thin metal film. (See Tadashi et al. discussed above; Machine translation 0006) (Applies to claim 26)

The difference not yet discussed is the biasing of the substrate. (Claim 20)

Regarding claim 20, Maniv is discussed above and teaches rf biasing the substrate. (See Maniv discussed above)

The motivation for utilizing a bias to the substrate is that it allows for increasing transparencies of the deposited film. (Column 3 lines 43-59)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an rf bias to the substrate because it allows for increasing the transparency of the film.

Art Unit: 1753

Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone and Yamaguchi further in view of Maniv et al. as applied to claims 19, 20, 21 and 26 above, and further in view of Ngan (EP 840 351).

The differences not yet discussed are where the target is made of titanium, tantalum or tungsten (Claim 22) and where the coil is made of titanium, tantalum and tungsten (Claim 23).

Regarding claims 22 and 23, Ngan teach utilizing a target and coil made of titanium. (Column 12 lines 40-43)

The motivation for utilizing a target and coil made of a material such as titanium is that it allows for depositing a layer more uniformly. (Column 9 lines 5-8)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a target and coil made of titanium as taught by Ngan because it allows for depositing a layer more uniformly.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone and Yamaguchi as applied to claims 19 and 21 above, and further in view of Gilboa et al. (U.S. Pat. 5,108,569).

The difference not yet discussed is the use of a shield ring and shield support member. (Claim 24)

Regarding claim 24, Gilboa et al. teach a shield ring and shield support member in Fig. 2 such that when the shield ring is supported by the substrate support member a gas can be introduced to the upper surface of the substrate. (See Gilboa et al. Fig. 2)

The motivation for utilizing a shield ring and shield support member is that it allows for clamping the wafer to the substrate support. (Column 8 lines 37-38)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a shield ring and support member as taught by Gilboa et al. because it allows for clamping the wafer to the substrate support.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone and Yamaguchi as applied to claims 19 and 21 above, and further in view of Chikako et al. (Japan 06-041733).

The difference not yet discussed is the use of a central port for a reactive gas centrally disposed through a substrate holder. (Claim 25)

Regarding claim 25, Chikako et al. teach introducing reactive gas through the center of a substrate holder. (See Abstract; Figure 1)

The motivation introducing the reactive gas through the center of the substrate is that it allows for suppressing reaction products from building up on the surface of the target. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a reactive gas inlet at the center of the substrate holder as taught by Chikako et al. because it allows for suppressing reaction products from building up on the surface of the target.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. (Japan 10-324969) in view of Sone (U.S. Pat. 6,451,184), Ngan (EP 840 351), Maniv et al. (U.S. Pat. 4,392,931) and Yamaguchi (U.S. Pat. 6,203,674).

Tadashi et al. is discussed above and all is as applies above. (See Tadashi et al. discussed above)

The differences between Tadashi et al. and the present claims is having a higher partial pressure of argon at the target than at the substrate, having a higher partial pressure of reactive gas near the substrate than at the target, the target made of titanium, tantalum or tungsten, the coil made of titanium, tantalum or tungsten, the substrate being biased and deposition of metallic layers.

Regarding claim 27, Since Tadashi et al. teach locating the argon proximate the target in Fig. 1 and locating the oxygen gas proximate the substrate in Fig. 1 the apparatus would have inherently higher partial pressures of argon proximate the target and higher partial pressures of oxygen proximate the substrate. (See Fig. 1) Sone further teaches partitioning the gas space such that reactive gas is contained between the partition member and the substrate and the sputter gas is maintained between the target and the partition member. This keeps the partial pressure of reactive gas higher at the substrate surface than at the target surface and keeps the partial pressure of argon gas higher at the target surface than at the substrate surface. (See Abstract) Furthermore, Sone recognizes that the prior art has attempted to keep the sputtering gas confined to the target and the reactive gas confined to the substrate. (Column 2 lines 17-22)

The motivation for utilizing a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate is that it allows for production of

compound films with in-plane uniform thickness and optical and electrical characteristics. (Column 3 lines 22-25)

Regarding claim 27, Ngan teach utilizing a target and coil made of titanium. (Column 12 lines 40-43)

The motivation for utilizing a target and coil made of a material such as titanium is that it allows for depositing a layer more uniformly. (Column 9 lines 5-8)

Regarding claim 27, Maniv is discussed above and teaches rf biasing the substrate. (See Maniv discussed above)

The motivation for utilizing a bias to the substrate is that it allows for increasing transparencies of the deposited film. (Column 3 lines 43-59)

Regarding the deposition of metallic film layers, Yamaguchi teach depositing a metallic mode TiN film by sputtering a target containing a layer amount of Ti components. The selective formation of metallic mode TiN film can be performed by adjusting the ratio of Ar gas and N₂ gas or setting the flow rate of N₂ to a predetermined rate or more. (Column 3 lines 1-13)

The motivation for depositing a metallic mode TiN film is that it allows for forming a layer for a semiconductor device. (Column 1 lines 5-20)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a higher partial pressure of argon at the target than at the substrate, to have utilized a higher partial pressure of reactive gas near the substrate than at the target as taught by Sone to have utilized a target made of titanium and coil made of titanium as taught by Ngan, to have utilized a biased substrate

as taught by Maniv et al. and to have deposited metallic layers as taught by Yamaguchi because it allows for depositing a layer uniformly with desired optical and electrical characteristics with increasing transparency and for depositing layers for semiconductors.

Claims 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. (Japan 10-324969) in view of Sone (U.S. Pat. 6,451,184), Takehara (U.S. Pat. 5,340,459) and Yamaguchi (U.S. Pat. 6,203,674).

Tadashi et al. is discussed above and all is as applies above. (See Tadashi et al.)

The difference between Tadashi et al. and the present claims is that having a high partial pressure of an inert gas inside the vacuum chamber proximate the sputtering target than at an upper surface of the substrate is not discussed and introducing a mixture of gas near the target and introducing a second gas near the substrate is not discussed and depositing metallic layers is not discussed.

Since Tadashi et al. teach locating the argon proximate the target in Fig. 1 and locating the oxygen gas proximate the substrate in Fig. 1 the apparatus would have inherently higher partial pressures of argon proximate the target and higher partial pressures of oxygen proximate the substrate. (See Fig. 1) Sone further teaches partitioning the gas space such that reactive gas is contained between the partition member and the substrate and the sputter gas is maintained between the target and the partition member. This keeps the partial pressure of reactive gas higher at the substrate surface than at the target surface and keeps the partial pressure of argon gas

Art Unit: 1753

higher at the target surface than at the substrate surface. (See Abstract) Furthermore, Sone recognizes that the prior art has attempted to keep the sputtering gas confined to the target and the reactive gas confined to the substrate. (Column 2 lines 17-22)

The motivation for utilizing a high sputtering gas pressure at the target and a higher reactive gas pressure at the substrate is that it allows for production of compound films with in-plane uniform thickness and optical and electrical characteristics. (Column 3 lines 22-25)

Takehara teach a pipe 3 for introducing a mixture of gas near the target. Takehara teach a pipe 4 for introducing a second gas near the substrate. (See abstract)

The motivation for utilizing a mixture of gas near the target and a second gas near the substrate is that it allows for equalizing the reaction of a reactive gas with a target material above the surface of the target. (Column 1 lines 60-63)

Regarding the deposition of metallic layers, Yamaguchi teach depositing a metallic mode TiN film by sputtering a target containing a layer amount of Ti components. The selective formation of metallic mode TiN film can be performed by adjusting the ratio of Ar gas and N₂ gas or setting the flow rate of N₂ to a predetermined rate or more. (Column 3 lines 1-13)

The motivation for depositing a metallic mode TiN film is that it allows for forming a layer for a semiconductor device. (Column 1 lines 5-20)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Tadashi et al. by keeping the partial

Art Unit: 1753

pressure of the inert gas higher at the target surface than at the substrate surface as taught by Sone et al., to have introduced a mixture of gas near the target and a second gas near the substrate as taught by Takehara and to have deposited metallic layers as taught by Yamaguchi because it allows for producing uniform thin films and for equalizing the reaction of a reactive gas with a target material above the surface of the target and for depositing metallic layers for semiconductors.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone et al., Takehara and Yamaguchi as applied to claims 28 and 29 above, and further in view of Maniv et al. (U.S. Pat. 4,392,931).

The difference not yet discussed is the biasing of the substrate.

Maniv is discussed above and teaches rf biasing the substrate. (See Maniv discussed above)

The motivation for utilizing a bias to the substrate is that it allows for increasing transparencies of the deposited film. (Column 3 lines 43-59)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an rf bias to the substrate because it allows for increasing the transparency of the film.

Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadashi et al. in view of Sone et al., Takehara and Yamaguchi as applied to claims 28 and 29 above, and further in view of Ngan (EP 840 351).

The differences not yet discussed are where the target is made of titanium, tantalum or tungsten and where the coil is made of titanium, tantalum and tungsten.

Art Unit: 1753

Regarding claims 31 and 32, Ngan teach utilizing a target and coil made of titanium. (Column 12 lines 40-43)

The motivation for utilizing a target and coil made of a material such as titanium is that it allows for depositing a layer more uniformly. (Column 9 lines 5-8)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a target and coil made of titanium as taught by Ngan because it allows for depositing a layer more uniformly.

REMARKS:

Applicant has argued that Tadashi does not teach depositing metallic layers on the substrate by utilizing a second gas introduced to the substrate. The Examiner argues that the primary reference Tadashi et al. teach that the second gas is introduced to react with the metal film to produce a metal oxide or metal nitride. As Applicant shows in their specification at Page 23 paragraph 0023 a metallic layer of TiN is deposited on the substrate. Tadashi et al. teach depositing aluminum oxide or aluminum nitride (AlN) on the substrate. Clearly a layer of AlN is a metallic layer containing aluminum and nitrogen similar to Applicant's TiN layer which contains titanium and nitrogen. It is noted that layers of TiN are insulating (i.e have various resistivities) when deposited in both the conventional process and Applicant's process as highlighted by Applicant in their Table 1. Therefore Tadashi et al. teach a metallic layer of AlN even though Applicant refers to this as a ultrathin resistive layer. There is confusion as to what Applicant considers to be a metallic layer i.e. a layer containing metal or a layer containing a metal and another element such as nitrogen. Furthermore

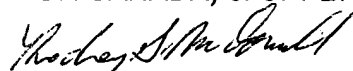
Art Unit: 1753

Yamaguchi has been cited to show that metallic mode TiN film can be deposited by controlling the amount of nitrogen in the atmosphere. This is similar to Applicant's claims because Applicant is utilizing metallic mode depositing to deposit metallic mode TiN films by controlling the amount on nitrogen in the atmosphere.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
August 8, 2006